TRANSMITTAL OF APPEAL BRIEF (Large Entity)

Docket No.
2000.110A

In Re Application Of:
Michael Y. Wen

Application No.	Filing Date	Examiner	Customer No.	Group Art Unit	Confirmation No.
10/657,360	Sept. 8, 2003	John C. Douglas	34477	1764	9508

Invention:
HEAVY OIL UPGRADE METHOD AND APPARATUS

COMMISSIONER FOR PATENTS:

Transmitted herewith is the Appeal Brief in this application, with respect to the Notice of Appeal filed on:
January 16, 2007

The fee for filing this Appeal Brief is: **$500.00**

☐ A check in the amount of the fee is enclosed.

☐ The Director has already been authorized to charge fees in this application to a Deposit Account.

☒ The Director is hereby authorized to charge any fees which may be required, or credit any overpayment to Deposit Account No. 05-1328. I have enclosed a duplicate copy of this sheet.

☐ Payment by credit card. Form PTO-2038 is attached.

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

Signature

Dated: **March 8, 2007**

Adam P. Brown, Reg. No. 52,657

ExxonMobil Upstream Research Company
P. O. Box 2189
Houston, Texas 77252-2189

Telephone: (713) 431-7649

cc:

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to "Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450" [37 CFR 1.8(a)] on
March 8, 2007
(Date)

Signature of Person Mailing Correspondence

Margaret Gnewuch

Typed or Printed Name of Person Mailing Correspondence

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Appl. No.	:	10/657,360	Confirmation No.: 9508
Applicant	:	Michael Y. Wen	
Filed	:	September 8, 2003	
TC/A.U.	:	1764	
Title:	:	HEAVY OIL UPGRADE METHOD AND APPARATUS	
Examiner	:	John C. Douglas	
Docket No.	:	2000.110A	
Customer No.	:	34477	Date: March 08, 2007

APPEAL BRIEF UNDER 37 C.F.R. § 41.37

Mail Stop Appeal Brief-Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In accordance with the provisions of 37 C.F.R. § 41.37, Appellants submit the following:

Table of Contents

I. REAL PARTY IN INTEREST

The real party in interest is ExxonMobil Upstream Research Company, the assignee of the present application.

II. RELATED APPEALS AND INTERFERENCES

Appellants, Appellants' counsel, and the assignee of the application are not aware of any other appeals or interferences which will directly affect or be directly affected by or have a bearing on, the Board's decision in the pending appeal.

III. STATUS OF CLAIMS

Claims 13-41 are pending and rejected in the application.

No claims are allowed.

Claims 13-41 are being appealed and are set forth in their entirety in the Claims Appendix submitted herewith.

IV. STATUS OF AMENDMENTS

A Response was entered subsequent to the final rejection. The Advisory Action considered the Response but did not allow any of the appealed claims.

V. SUMMARY OF THE INVENTION CLAIMED SUBJECT MATTER

Claim 13 is an independent claim. It is drawn to a heavy oil upgrading process of high temperature thermal cracking, quenching with a quench oil, and stabilizing below 850 degrees F. Paragraph [0017] and original claim 13.

Claim 14 depends from claim 13. It requires thermal cracking for less than two seconds. Paragraph [0043] and original claim 14.

Claim 15 depends from claim 14. It requires a predominantly gas phase thermal cracking reaction. Paragraph [0059] and original claim 15.

Claim 16 depends from claim 15. It requires heavy oil quench. Paragraph [0032] and original claim 16.

Claim 17 depends from claim 16. It requires a fresh feed stream of heavy oil. Paragraph [0058] and original claim 17.

Claim 18 depends from claim 17. It requires either the supplement of either recycled quenched oil or stabilized oil. Paragraph [0060] and original claim 18.

Claim 19 depends from claim 18. It requires a total mass flow rate at least 10 times the fresh feed stream. Paragraph [0060] and original claim 19.

Claim 20 depends from claim 16. It requires upgrading to lighter oil in both the cracking and stabilization steps. Paragraph [0054] and original claim 20.

Claim 21 depends from claim 20. It requires at least 30 percent of the total upgrading to be in the stabilization step. Paragraph [0054] and original claim 21.

Claim 22 depends from claim 16. It requires process production of less than 4 weight percent C1 to C4 hydrocarbons. Paragraph [0061] and original claim 22.

Claim 23 depends from claim 22. It requires production of less than 1 weight percent C1 to C4 hydrocarbons. Paragraph [0061] and original claim 23.

Claim 24 depends from claim 16. It requires the quenched oil product to be stabilized for 25-50 minutes. Original claim 24.

Claim 25 depends from claim 16. It requires the hydrogen-containing gas to be syngas produced primarily from air and containing hydrogen gas. Paragraph [0048] and original claim 25.

Claim 26 depends from claim 25. It requires thermal cracking pressure of 200-600 psig. Paragraphs [0057] and original claim 26.

Claim 27 depends from claim 26. It requires thermal cracking at hydrogen gas partial pressure of 40-120 psia. Paragraph [0057] and original claim 27.

Claim 28 depends from claim 27. It requires that the syngas (claim 25) be produced from steam and a hydrocarbon gas at a 0.5:1 to 2.0:1 molar ratio. Paragraph [0048] and original claim 28.

Claim 29 depends from claim 16. It requires that the process produce less than 1.0 wt.% coke on a fresh feed basis. Paragraph [0061] and original claim 29.

Claim 30 depends from claim 29. It requires less than 0.5 wt.% coke production on a fresh feed basis. Paragraph [0061] and original claim 30.

Claim 31 depends from claim 30. It requires less than 0.1 wt.% coke production on a fresh feed basis. Paragraph [0061] and original claim 31.

Claim 32 depends from claim 16. It requires a 1050 degrees F conversion of greater than 30 wt.%. Paragraphs [0088 and 0090] and original claim 32.

Claim 33 depends from claim 32. It requires a 1050 degrees F conversion of greater than 35%. Paragraphs [0088 and 0090] and original claim 33.

Claim 34 depends from claim 16. It requires a stabilizing step RSI (875degrees F) of below 300 seconds. Paragraphs [0055-0056] and original claim 34.

Claim 35 depends from claim 16. It requires a stabilizing step RSI (875 degrees F) of below 200 seconds. Paragraphs [0055-0056] and original claim 35.

Claim 36 depends from claim 16. It requires 90 wt.% or greater liquid products. Paragraph [0087] and original claim 36.

Claim 37 depends from claim 36. It requires 95 wt.% or greater liquid products. Paragraph [0087] and original claim 37.

Claim 38 depends from claim 16. It requires a non-catalytic process. Paragraphs [0017 and 0031] and original claim 38. Compare paragraph [0007].

Claim 39 depends from claim 16. It requires a feed including up to 5 wt.% solids. Paragraph [0065] and original claim 39.

Claim 40 depends from claim 16. It requires the further step of separating a heavy oil fraction and recycling said fraction to the thermal cracking step. Paragraph [0080] and original claim 40.

Claim 41 is an independent product-by-process claim that incorporates the claim 13 process. It requires a stabilized oil product from a heavy oil upgrading process of high temperature thermal cracking, quenching with a quench oil, and stabilizing below 850 degrees F. Paragraph [0017] and original claims 13 and 41.

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

The issues presented for review are:

whether the Examiner erred in finally rejecting:

Claim 41 under 35 USC 102(b) as anticipated by Khan, U.S. Patent No. 6059957 ("Khan") for Khan's disclosure of a stabilized light oil product at column 6, lines 46-55 and citing MPEP 2113 for the principle that the Khan product reasonably appears to be either identical with or slightly different from the claim 41 product;

Claims 13-18, 20, 21, 25-27, and 34-40 under 35 USC 103(a) over Chahvekilian et al. U.S. Patent No. 3842138 ("Chahvekilian") in view of Khan and Gomi U. S. Patent No. 3689401 ("Gomi"), rebutting Appellant's previous response because Chahvekilian shows heavy oil upgrading and because nonobviousness cannot be shown by attacking references individually where the rejection is based on a combination;

Claims 22, 23, 32, and 33 as above and further in view of Gregoli et al. U.S. Patent No. 6016868 ("Gregoli") for Gregoli's disclosure of a product containing 1.12 wt. % C1- C4 hydrocarbons;

Claims 19 and 29-31as above over three references and further in view of Benham U.S. Patent No. 6,004,453 ("Benham") for Benham's disclosure of coke reduction/elimination by increased heavy gas oil recycling; and

Claim 28 over the three references as above, and further in view of Fuderer U.S. Patent No. 4822521 ("Fuderer") for Fuderer's disclosure of a syngas production.

VII. ARGUMENT

The Rejections

Claim 41

Claim 41 was finally rejected as lacking novelty over Khan, referring to Khan's disclosure of stabilized light oil, and MPEP 2113.

The Error in the Rejection

The error in the rejection is that the specification disclosure of the product of a process included in the subject matter of process claim 13 makes it clear that the product of the invention cannot be expected to be even similar to that of Khan, let alone identical or slightly different.

Based on even the most elementary chemical reaction principles, the product of the Khan reaction cannot be expected to be even similar (let alone identical) to that of Khan, even if identical heavy oil feeds were to be used.

Claim 41 requires that the product claimed be made by the process of claim 13. Claim 13 requires thermal cracking at a process temperature very different from that of Khan. Claim 13 also requires two distinct quenching and stabilizing steps with a temperature limitation of, below 850 degrees F, for the third step.

The thermal cracking step of the claim requires a temperature above 1225 degrees F whereas the art recites the cracking step at about 400 degrees C or about 775 degrees F. See Khan at: column 1, lines 30-31 (describing the prior art); column 4, lines 12-14 (gas is cooled to a temperature appropriate to the operation of the upgrading unit); column 4, line 27 (unit operation at 400-440 degrees C); and Example 1 (425 degrees C cracking).

Khan teaches:

lower cracking temperature;
the use of an oil and water emulsion;
preferably a surfactant in the emulsion;
apparently no quenching and stabilizing regimes; and
the use of catalyst.

Based on even the most elementary chemical reaction principles, the product of the reaction cannot be expected to be even similar (let alone identical) to that of Khan, even if identical heavy oil feeds were to be used. These differences are supported by the simulated results of certain embodiments of the PCU process at pages 24-29; the Examples data of Tables 6, 7, and 8 which show no coke production (Table 7, column 2); improved liquid properties; and reduced production of light gases compared to those expected in the prior art. See especially the discussion at paragraph [0087].

Certainly the reaction product without quenching at about 775 degrees F as in Khan cannot be expected to produce the same hydrocarbon and related products mixture as the invention of claim 13 (incorporated in claim 41) at 1225 degrees F followed by rapid quenching within 10 seconds. Applicant has demonstrated improved API of the remixed light oil and heavy crude product and production or a reduced amount of light gases. The process steps by which the product is made should be considered when they are expected to impart distinctive characteristics to the final product; see MPEP 2113. Reversal of the rejection of claim 41 is respectfully requested.

Claims 13-18, 20, 21, 25-27, and 34-40

The Error in the Rejection

The error in the rejection is that the skilled artisan is not directed to combine the light hydrocarbon cracking of Chahveklian to the heavy oil process of Kahn; and because neither Kahn nor Gomi teach the combined quenching and stabilization steps of the invention.

The high temperature heavy oil thermal cracking process of the invention is not disclosed or suggested in any reference.

The thermal cracking step of the claim requires a temperature above 1225 degrees F whereas the art recites the cracking step at about 400 degrees C or about 775 degrees F. See the arguments above regarding product-by-process claim 41, with respect to the process steps.

The primary reference Chahvekilian does not upgrade heavy oil and uses steam cracking with a lighter feed. The skilled artisan would not be led to use the Chahvekilian process with the heavy oils of Khan because such heavy oil processes were conducted at lower temperatures and there was no indication of how to conduct the process at higher temperature so as to upgrade the oil. Also, there was no indication of how to incorporate a hydrogen-containing stream into the steam cracking process of Chahvekilian, certainly a dangerous proposition.

Even though Khan shows a heavy oil upgrade process, there is nothing in any of the cited references teaching a high temperature upgrading followed by quenching with a quench oil, and stabilizing the quenched product below 850 degrees F for 1 to 60 minutes. The stabilizing of Gomi is with an organic sulfur treatment to stabilize aromatics and this would not teach or suggest to the skilled artisan how to stabilize the quench oil/light oil product as per claim 13.

The primary reference Chahvekilian does not disclose upgrading a heavy oil with a hydrogen-containing stream but rather discloses a cracking process for hydrocarbons typical of those downstream from the heavy API materials of this invention. Nothing suggests applying the heavy oil upgrade of Khan to the higher temperature process of Chahvekilian, *contrary to the*

explicit teaching of Khan to operate at lower temperatures. Furthermore, no apparatus or device is disclosed, in either reference, for contacting thermally cracked oil product with the quench oil in a manner that permits quenching and stabilization as required by independent claim 13. Accordingly, the proposed application of Khan's heavy oil process to Chahvekilian's process would not result in the claimed invention, especially since the reference's gas recycle does not suggest use of a quench oil. The skilled artisan applying Khan would at best be led to recycle light gases back to quench Chahvekilian's process, not use a quench oil.

Application of the thermal stabilization of Gomi does not complete the present invention. While the temperatures of Gomi are within the ambit of claim 13 stabilizing temperatures, Gomi uses organic sulfur and a catalyst to stabilize a heavy oil by-product stream **prior** to hydrorefining and eventual olefin reaction. Accordingly, the stabilizing treatment of Gomi adds the organic sulfur compound prior to hydrorefining the heavy oil and the product thereof is changed because of this addition. Gomi does not teach stabilization after hydrorefining the heavy oil and the skilled artisan is not led to do so. No stabilization is taught after cracking and quenching.

Since independent claim 13 is distinguished over the combination of three references, the remaining claims dependent thereon are also allowable. Reversal of the rejection is respectfully requested.

Claims 22, 23, 32, and 33

The Error in the Rejection

While Applicant acknowledges that Gregoli discloses removing low carbon hydrocarbons and other undesirable gases from a raw crude, the error in the rejection is that the skilled artisan would not apply such gas separation technology to the process of the other three references combined, or if he did, a very different process would result.

The high temperature, thermal cracking, quenching, and stabilization of the invention is not taught or suggested in any reference or combination and Gregoli does not supply the missing teachings (even though a separation is shown).

Even if, *arguendo,* Gregoli's separation was applied, there is a strong concern that the process of the combined references might *produce* high levels of gases without the quench oil and stabilization set forth in independent claim 13. That is, even if gases are taken "off the top", there is no indication to the skilled artisan that more won't be produced; or if produced, how to minimize such production. Only the claimed invention teaches that.

Regarding claims 32-33, see the specification at paragraph [0054]. While Gregoli recognized a hydrogen concentration/pressure technique for improving product quality, there is nothing in Gregoli to suggest applying a technique successful in a hydrovisbreaking operation (to produce syncrude), to a heavy oil upgrade. Applicant has shown the ability to improve product quality (no coke) and reduce gases with the necessary amount of hydrogen-containing gas by appropriate quenching and stabilizing. That is, the process of Gregoli would at best be supplemental to the invention and the references would still lack the teaching of high temperature cracking followed by oil quench, as discussed above. Reversal of the rejection is respectfully requested.

Claims 19 and 29-31

The Error in the Rejection

While Appellant acknowledges that Benham discloses coke reduction by increased heavy gas oil recycling, the error in the rejection is that the primary references combined with Benham still fail to combine to teach the invention.

The conditions of the claim are not met or suggested by the references taken individually or in concert.

While the Benham teaching might be used to supplement the process of the invention, there is no suggestion in any of the four references to operate the cracking and quench at the conditions indicated by independent claim 13. Reversal of the rejection is respectfully requested.

Claim 28

The Error in the Rejection

While Fuderer is exemplary of a syngas production, the basics of the claimed invention are nowhere taught or suggested in FOUR references.

There is no suggestion in Fuderer to apply the methane syngas reformer process to heavy oil cracking, especially since Fuderer is directed to merely syngas production. Certainly, the reference doesn't suggest applying the steam reforming ratio to a heavy oil cracking process with quench oil as set forth in independent claim 13. Reversal of the rejection is respectfully requested.

Why Claims 1-13 are Patentable Under 35 U.S.C. § 103

(i) The Examiner bears the initial burden of factually supporting any *prima facie* conclusion of obviousness. MPEP §2142. In particular, the initial burden is on the Examiner to find some motivation or suggestion to make the claimed invention in light of the prior art teachings. The suggestion to modify must be "clear and particular." In re Sang Su Lee, 277 F.3d 1338, 1343, 61 USPQ2d 1430, 1433-1434 (Fed. Cir. 2002); Winner Int'l Royalty Corp. v. Ching-Rong Wang, 202 F.3d 1340, 1348-1349, 53 USPQ2d 1580, 1586-1587 (Fed. Cir. 2000).

In the present case, the Examiner has not met the initial burden of identifying a motivation or suggestion within Kahn to operate in the claimed temperature domain and provide the missing process steps of quenching and stabilizing.

Specifically, the Examiner has concluded that Kahn discloses the claimed high temperature process of the invention. Appellants disagree and invite the Board to review the cited portions that form the basis of the rejection. Nowhere in the abstract or disclosure of any of the cited references is there any teaching of the process temperature and the supplemental references provide neither that for heavy oil processing nor the subsequent steps of the invention claimed.

The Distinction of the Claimed Invention

The invention provides both an apparatus and process capable of accomplishing the high temperature conversion of heavy oil and the required quenching and stabilizing steps. The references do not suggest this. It is inappropriate to apply the steam cracking thermal characteristics of Chahvekilian to a heavy oil process.

The Improvement of the Claimed Invention

See the present specification at Examples 1 and 2, paragraphs [0086-0090] for a review of the improved yields with high yields, low coke production, high liquid product portion, and low C1-C4 gas production according to the invention. The skilled artisan could hardly have been expected to apply steam cracking to the prior art, low temperature process to devise the invention since both the processes and normal operating conditions are so far removed from each other.

In the present case, the invention is not only patentable over the prior art, but also an improvement thereover for handling of heavy oil processing.

Respectfully submitted,

Date: March 8, 2007

John F. Hunt
Reg. No. 29,394

ExxonMobil Upstream Research Company
P. O. Box 2189
Houston, Texas 77252-2189

VIII. CLAIMS APPENDIX

CLAIMS ON APPEAL:

13. A heavy oil upgrading process, said process producing 80 wt.% or greater of liquid products, said process comprising:

a) thermally cracking a feed oil comprising heavy oil at a temperature above 1225°F for less than 10 seconds in the presence of a hydrogen-containing gas to produce a thermally cracked oil product;

b) quenching said thermally cracked oil product within 10 seconds of the initiation of said thermal cracking of said feed oil by mixing said thermally cracked oil product with a quench oil to form a quenched oil product; and

c) stabilizing the quenched oil product at a temperature below 850°F for from 1 to 60 minutes to form a stabilized oil product.

14. A process according to Claim 13, wherein said thermally cracking step's duration is less than 2 seconds.

15. A process according to Claim 14, wherein said thermally cracking step is predominantly a gas phase thermal cracking reaction.

16. A process according to Claim 15, wherein said quench oil comprises heavy oil.

17. A process according to Claim 16, further including providing a fresh feed stream of heavy oil to said process at a first mass flow rate.

18. A process according to Claim 17, wherein the feed oil provided to said thermal cracking step (a) comprises recycled quenched oil product and/or stabilized oil product.

19. A process according to Claim 18, wherein the total mass flow rate of feed oil provided to said thermal cracking step (a) is at least 10 times greater than said first mass flow rate of said fresh feed stream.

20. A process according to Claim 16, wherein heavy oil is upgraded to lighter oil in both said thermal cracking step (a) and in said stabilization step (c).

21. A process according to Claim 20, wherein at least 30 percent of the total upgrading of said heavy oil occurs in said stabilization step (c).

22. A process according to Claim 16, wherein said process produces less than 4 weight percent of C_1 to C_4 hydrocarbons.

23. A process according to Claim 22, wherein said process produces less than 1 weight percent of C_1 to C_4 hydrocarbons.

24. A process according to Claim 16, wherein said quenched oil product is stabilized for from 20 to 50 minutes.

25. A process according to Claim 16, wherein said hydrogen-containing gas is syngas produced primarily from air as an oxidizing agent, said syngas containing hydrogen gas.

26. A process according to Claim 25, wherein said thermal cracking step (a) is conducted at a system pressure of 200 to 600 psig.

27. A process according to Claim 26, wherein said thermal cracking step (a) is conducted at a hydrogen gas partial pressure of from 40 to 120 psia.

28. A process according to Claim 27, wherein said syngas production further includes the use of steam and a hydrocarbon gas, said steam to hydrocarbon gas molar ratio being from 0.5:1 to 2.0:1.

29. A process according to Claim 16, wherein said process produces less than 1.0 wt.% of coke on a fresh feed oil basis.

30. A process according to Claim 29, wherein said process produces less than 0.5 wt.% of coke on a fresh feed oil basis.

31. A process according to Claim 30, wherein said process produces less than 0.1 wt.% of coke on a fresh feed oil basis.

32. A process according to Claim 16, wherein said process produces 1050°F conversion of greater than 30 wt.%.

33. A process according to Claim 32, wherein said process produces 1050°F conversion of greater than 35 wt.%.

34. A process according to Claim 16, wherein the reaction severity index ($RSI_{875°F}$) of said stabilizing step is below 300 seconds.

35. A process according to Claim 16, wherein the reaction severity index ($RSI_{875°F}$) of said stabilizing step is below 200 seconds.

36. A process according to Claim 16, wherein said process produces 90 wt.% or greater of liquid products.

37. A process according to Claim 36, wherein said process produces 95 wt.% or greater of liquid products.

38. A process according to Claim 16, wherein said process is a non-catalytic process.

39. A process according to Claim 16, wherein said feed oil includes up to 5 wt.% of solids.

40. A process according to Claim 16, further including :

d) separating from said stabilized oil product a heavy oil fraction and recycling said heavy oil fraction to said thermal cracking step (a).

41. A stabilized oil product made by the process of Claim 13.

EVIDENCE APPENDIX

Pursuant to 37 C.F.R. § 41.37(c)(1)(ix), submitted herewith are copies of any evidence submitted pursuant to 37 C.F.R. §§ 1.130, 1.131, or 1.132 or any other evidence entered by the Examiner and relied upon by Appellant in the appeal.

NONE

RELATED PROCEEDINGS APPENDIX

Submitted herewith are copies of decisions rendered by a court or the Board in any proceeding identified in Section II pursuant to 37 C.F.R. § 41.37(c)(1)(ii).

NONE